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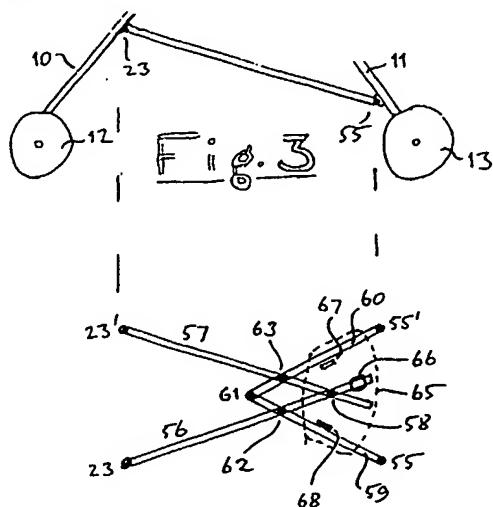
# UK Patent Application (19) GB (11) 2 380 981 (13) A

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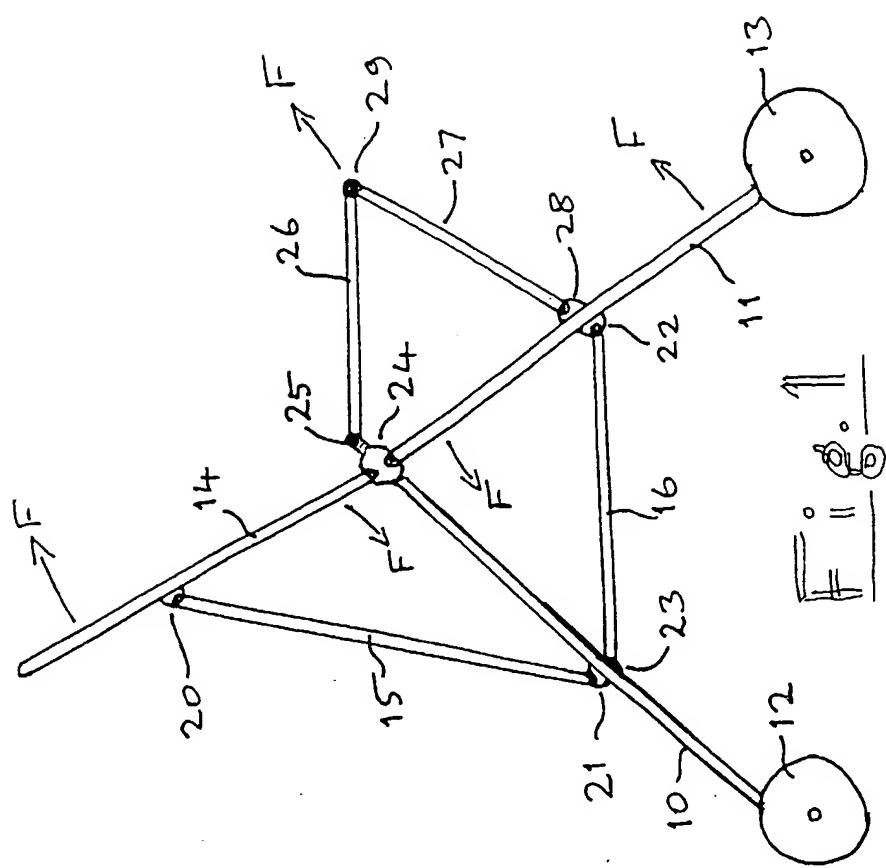
(54) Abstract Title  
**A foldable push-chair linkage**

(57) A push-chair having two side frames (Fig 1), wherein each is foldable and is linked by horizontal Fig 3, and vertical linkages (Fig 2) which allow the two side frames to be folded together, characterised in that the horizontal linkage comprises a pair of 'X' linkages 56, 59 and 57, 60 in an overlapping diamond arrangement. Preferably the 'X' linkages are a first pair of struts 56, 57 hinged to the rear side frame 10 at a hinge point 23 and hinged together at another hinge point 58 and a second pair of struts 59, 60 hinged to the front side frame 11 at hinge point 55 and hinged together at hinge point 62. Preferably one first and one second strut is hinged together at each side 62, 63 and each pair of struts is hinged together 58, 61 to form an overlapping diamond shape. Advantageously the horizontal reach of the linkage is increased and can be coupled to the side frames at a low level therefore increasing the distance between the base of the seat and the linkage thus increasing the space available for the storage of goods.

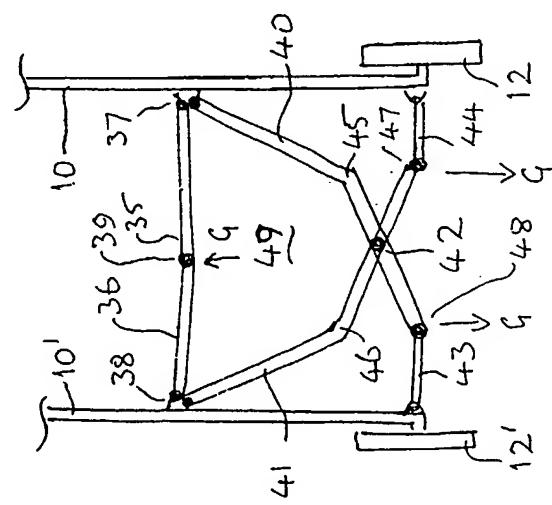


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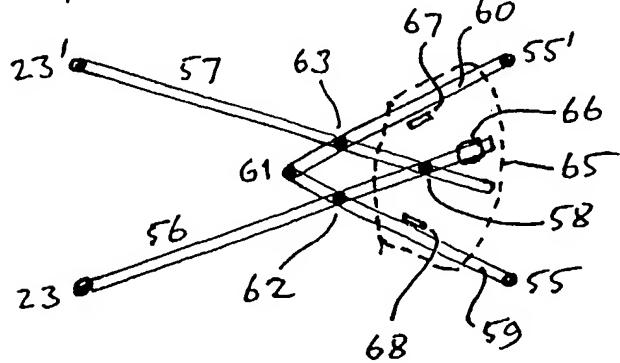
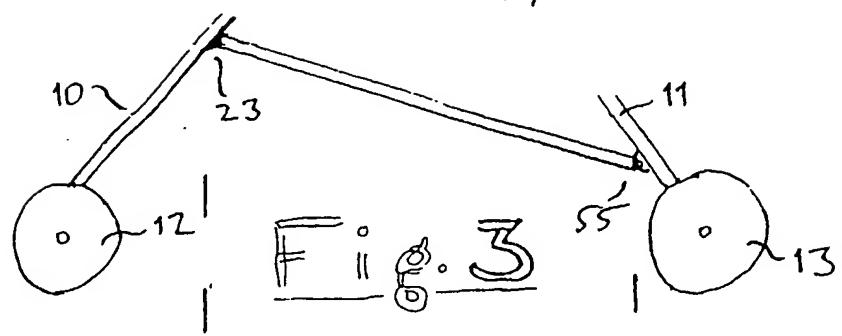
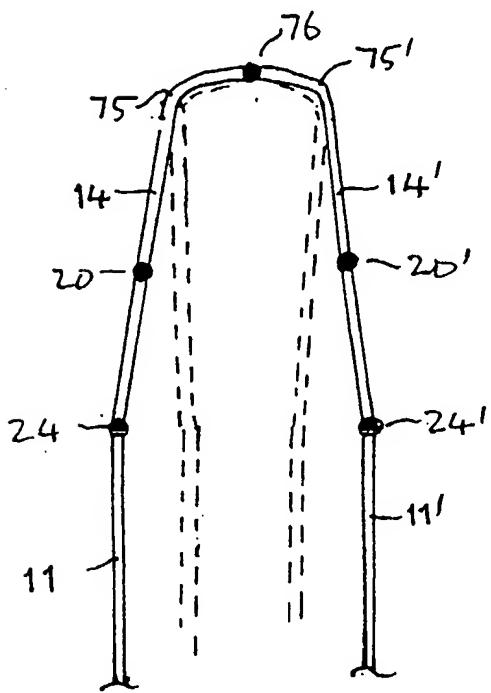


Fig. 4



**Child's Push-Chairs**

5        The present invention relates to folding push-chairs for children, and more specifically to the low-level horizontal linkage between the frame bars in a push-chair with a 3-dimensional fold.

With a 3-dimensional fold chair, each side frame can be folded, and the  
10      two side frames can also be moved together to reduce the width of the chair. This requires appropriate linkages between the two side frames. There are generally two distinct linkages, one broadly horizontal and coupled to the side frames near their bottom ends, and the other roughly vertical or at least rising and joining the side frames near their bottom rear portions and somewhere  
15      roughly in the region of the back of the seat.

There are two main forms of linkage used in such chairs between the two side frames. One is an X linkage, consisting of two bars hinged to each other at the point where they cross and each of which extends between the two  
20      side frames (and is hinged to them at its ends). The other is a broken bar linkage, consisting of two half-bars hinged together so that in the extended position they effectively form a roughly straight bar between the two side frames. An X linkage is normally used for the horizontal linkage; a broken-bar linkage, or a linkage incorporating a broken bar, is often used for the  
25      vertical linkage.

The front-to-back length of the horizontal X linkage is generally relatively restricted. Since the front and rear sloping bars of each side frame are sloping away from each other, this requires the X linkage to be fixed at a

relatively short distance below the base of the seat, so restricting the space beneath the seat available for storage.

The object of the invention is to provide an improved X linkage.

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According to the invention there is provided a push-chair having two side frames, each side frame being foldable and the two side frames being linked by horizontal and vertical linkages which allow the two side frames to be folded together, characterized in that the horizontal linkage comprises a pair 10 of X linkages in an overlapping diamond arrangement.

The two X linkages may be at different angles.

This arrangement allows the horizontal extent or reach of the linkage to 15 be increased for a given width (the width being fixed by the desired distance between the side frames of the push-chair). The linkage can therefore be coupled to the sloping bars of the side frames at a relatively low level. This increases the distance between the base of the seat and the linkage, and so increases the space available for storage of goods, etc.

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In addition, the increased reach of the linkage results in parts of it projecting sufficiently forward of the seat that a foot rest can be mounted on it.

A push-chair embodying the invention will now be described, by way of 25 example, with reference to the drawings, in which:

Fig. 1 is a side view of the push-chair showing the side frame structure;

Fig. 2 is an end view of the push-chair showing the structure of the vertical linkage between the side frames;

Fig. 3 is a top view showing the structure of the horizontal linkage 30 between the side frames; and

Fig. 4 is an end view of the push-chair showing the upper sloping struts and the handle structure.

Fig. 1 shows one side frame of the push-chair in simplified and diagrammatic form. The other side frame is of course similar, and the two sides are spaced apart by cross-bars (not shown) which can take a variety of forms. In some types of push-chair, the cross-bars are hinged or pivoted, so that when the chair is folded, the two side frames are fold together (typically in what is termed an umbrella or 3-dimensional fold); in others, the cross-bars are fixed and the chair folds so that each side frame collapses but the two side frames remain the same distance apart - a 2-dimensional fold.

The side frame has three main diagonal struts: a sloping rear strut 10, a sloping front strut 11, and a sloping handle strut 14. The rear and front struts 10 and 11 have wheels 12 and 13 mounted on their bottom ends as shown; the top end of the handle strut 14 has handle means (typically a handle, or a cross-bar forming a handle) attached to it. The chair side also has two further major struts, a vertical strut 15 and a horizontal strut 16. (The terms "vertical" and "horizontal" are used as a convenient contrast to "sloping", but indicate rough directions only.)

Bar 15 is hinged to strut 14 at a pivot 20 and to strut 10 at a pivot 21, and strut 16 is hinged to strut 11 at a pivot 22 and to strut 10 at a pivot 23. The two pivots 21 and 23 are preferably close together, and can be formed by a common pivot structure mounted on strut 10. The strut 10 also carries a slider structure 24, to which the ends of the struts 11 and 14 are pivoted as shown. The movement of the slider 24 upward along the strut 10 is limited by an end stop 25.

The basic fold is achieved by sliding the slider structure 24 up and down the strut 10. With the slider 24 at the top of the strut, the side frame is in the extended position substantially as shown, with the struts 11 and 14 aligned. Locking means (not shown) are provided to lock the slider 24 against the end  
5 stop 25; these locking means operate automatically as the slider reaches the end stop, and can then be released manually to allow the chair to be folded.

To fold the chair, the slider is moved down the strut 10. This rotates the strut 11 anticlockwise and the strut 14 clockwise (under the constraint of the  
10 struts 15 and 16), as shown by the arrows F, until they are aligned with the strut 10. For effective folding, the length of strut 15 (up to the pivot point 20) minus the length of strut 14 must match the length of strut 16 minus the length of strut 11 (down to the pivot point 22).

15 The chair seat is a flexible structure (typically of canvas or similar material) if the chair folds 3-dimensionally. The seat back can conveniently extend roughly vertically more or less along the line defined by bar 15 when in the upright position, and the seat base can conveniently extend roughly horizontally along the line defined by bar 16.

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For the purposes of the folding structure described above, the nature of the chair seat is not relevant, and could be a rigid structure if the chair is to fold only front-to-back; for this purpose, also, a footrest can be provided, eg on an extension (not shown) of strut 16.

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An arm-rest is provided by a horizontal strut 26 and a vertical strut 27. Bar 26 is hinged to the end 25 of strut 10, and strut 27 is hinged to a pivot 28 on strut 11. The two pivots 22 and 28 are preferably close together, and can be formed by a common pivot structure on strut 11. The struts 26 and 27 are also  
30 pivoted together at their other ends 29 as shown. When the chair is folded, the

two struts 26 and 27 move toward each other, with their pivot point 29 moving to the right as indicated by the arrow. For effective folding, the distance along strut 10 from the pivot point 23 to its end stop 25 plus the length of the strut 26 must match the sum of the lengths of the struts 16 and 27.

5

Fig. 2 shows the vertical linkage between the two side frames, with the bar 10 and wheel 12 of the first side frame and the corresponding bar 10' and wheel 12' of the opposite side frame being shown. The linkage consists of a broken bar linkage 35-37 and an extended X linkage 40-43.

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More specifically, the broken bar linkage consists of two bars 35 and 36 which are hinged together at their ends at 39. Bar 35 is hinged to the strut 10 at a point 37, which is adjacent to the hinge point 21-23 (Fig. 1); bar 36 is hinged to strut 10' at a corresponding hinge point 38. The hinge 39 is 15 preferably a locking hinge which allows hinging in one direction but not the other, with a slightly over-centre the stop position. The bars 35 and 36 are shown in the locked position; the hinge 39 allows the hinge 39 to move upward but not downward from the position shown. This broken-bar linkage serves to hold the side frames a fixed distance apart; it obviously prevents them from 20 moving further apart, and also prevents them from moving together (unless it is deliberately released by raising its mid-point).

The extended X linkage comprises two main struts 40 and 41. Strut 40 is hinged to side frame 10 at its upper end at the hinge point 37 which is also 25 the hinge point of the broken bar strut 35; strut 41 is hinged to side frame 10' at its upper end at the hinge point 38 which is also the hinge point of the broken bar strut 36. The struts 40 and 41 are also hinged together where they cross at a hinge point 42. An auxiliary strut 43 is hinged at hinge point 48 to the lower end of strut 40 and to the side frame strut 10' adjacent to the wheel 12'; an

auxiliary strut 44 is hinged at hinge point 47 to the lower end of strut 41 and to the side frame strut 10 adjacent to the wheel 12.

When the push-chair is opened (unfolded), as shown, the broken bar  
5 linkage 35-36 holds the two side frames a fixed distance apart. The struts 40  
and 41 then form a rigid triangle between the hinge points 37, 38, and 42. The  
hinge points 47 and 48 are therefore also fixed, and the struts 43 and 44  
therefore determine the positions of the bottom ends of the side arm struts 10  
and 10'. The extended X linkage thus holds the two side frame struts 10 and  
10' rigidly a fixed distance apart.

To fold the two side frames together, the hinge point 39 of the broken  
strut linkage 35-36 is raised, as shown by arrow G. This causes the extended  
X linkage to collapse, with the hinge points 47 and 47 moving downward.  
15 The lengths of the various struts are chosen so that the two side frames can be  
fully collapsed together.

It is evident that there is a substantial area 49 between the two linkages  
(the broken bar linkage and the extended X linkage) in the open (unfolded)  
20 state of the push-chair. Further, the area is increased by virtue of the bends in  
the struts 40 and 41. The present arrangement therefore enables relatively easy  
access to a bag or tray (not shown) provided beneath the base of the seat of the  
push-chair.

25 Fig. 3 shows the horizontal linkage between the two side frames of the  
present push-chair. (Up to this point, it has been assumed that the horizontal  
linkage between the two side frames is conventional, and has been shown  
purely diagrammatically as linkage 16.) The actual linkage extends between  
the hinge point 23 and a hinge point 55 which is below the point 22, as shown  
30 in the upper part of Fig. 3.

Referring to the lower part of Fig. 3, two struts 56 and 57 are hinged to the rear sloping side frame struts 10 and 10' at hinge points 23 and 23' and are hinged together at 58. A second pair of struts 59 and 60 are hinged to the front sloping side frame struts 11 and 11' at hinge points 55 and 55' and are hinged together at 61. The struts 56 and 59 are hinged together at 62, and the struts 57 and 60 are hinged together at 63. The struts 56, 57, 59, and 60 form a diamond shape between the hinge points 58, 61, 62, and 63.

It is clear that this linkage can be opened out and closed up. For opening out, the angle between the struts 56 and 57 increases, as does the angle between the struts 59 and 60. The distance between the hinge points 23 and 23' increases, and the distance between the hinge points 55 and 55' increases similarly; these two distances always remain equal. The distance between the hinge points 23 and 55 decreases on such opening out, as does the corresponding distance between the hinge points 23' and 55'. There is essentially only one parameter for the linkage, so if one distance (eg the distance between hinge points 23 and 23') is given, all the other angles and distances are fixed (subject to mechanical tolerances).

The angle between the struts 56 and 57 need not be the same as the angle between the struts 58 and 69. Thus the diamond shape formed by these four struts may be distorted from a mathematically precise diamond to a kite shape.

By a suitable choice of the geometry, the distance between hinge points 23 and 55 can be adjusted to allow a relatively long reach of the linkage while achieving satisfactory 3-dimensional closing of the push-chair.

A footrest 65 is mounted on the end of strut 56 by means of mounting means 66. The extended reach of the linkage and the forward position of the hinge points 55 result in the footrest being located forward of the seat base, in a position which is acceptable for occupants of the push-chair. The footrest is  
5 narrow enough to match the width of the push-chair in the folded state; on folding, the footrest slides slightly over the struts 57, 59, and 60. The footrest is of course supported against the weight of a user's feet by resting on all the struts 56, 57, 59, and 60. The footrest has stops 67 and 68 mounted on its underside which engage against the struts 59 and 60 in the unfolded state; this  
10 gives additional stability to both the footrest and the linkage in that state.

Fig. 4 is a simplified end view of the push-chair showing the handle structure and associated elements. The side frame shown in Fig. 1 has a lower front sloping strut 11 and an upper front sloping strut 14, joined at the slider  
15 24, and the opposite side frame has corresponding struts. The handle structure is located at the top end of the struts 14 and 14'. As shown in Fig. 4, the struts 14 and 14' lean slightly toward each other, so that the distance between them reduces as one gets closer to their top ends. Further, these struts have curved regions 75 and 75' at their top ends. These curved regions meet at the top  
20 centre of the chair in a hinge point 76.

When the chair is folded, the two side frames move together. This results in the struts 14 and 14' hinging about the hinge point 76, bringing their bottom ends (at the sliders 24 and 24') toward each other, as indicated by the  
25 broken lines. The width of the chair at handle region remains substantially unchanged by this. However, the width at this region is substantially less than the unfolded width of the chair at and below the seat region, so the width of the chair is substantially reduced by folding. In fact, the width of the handle region can be chosen to match the folded width of the chair at and below the  
30 seat region, so the handle region does not limit the folded width of the chair.

It will be realized that the struts 14 and 14' rotate slightly in their common plane (transverse to the planes of the side frames). Accordingly, their mountings on the sliders 24 and 24', and the hinging of the struts 15 (or the 5 vertical linkage between the side frames) to these struts must be designed to allow this slight rotation.

The hinge 76 can be covered by a sleeve of suitable plastic material if desired.

**Claims**

5    1     A push-chair having two side frames, each side frame being foldable and the two side frames being linked by horizontal and vertical linkages which allow the two side frames to be folded together, characterized in that the horizontal linkage comprises a pair of X linkages in an overlapping diamond arrangement.

10

2     A push-chair according to claim 1 characterized in that the two X linkages are at different angles.

3     A push-chair according to either previous claim characterized in that the  
15    horizontal linkage has a footrest mounted on it.

4     A push-chair substantially as herein described with reference to Fig. 3.



Application No: GB 0301706.8  
Claims searched: 1 - 4

Examiner: Beverley Lloyd  
Date of search: 14 February 2003

## Patents Act 1977 : Search Report under Section 17

### Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance
A	-	EP0908370 A2 (CONVAID) See Figs & abstract
A	-	WO86/01476 A1 (HINCHLIFFE) See Figs & abstract

### Categories:

- |   |   |   |  |
|---|---|---|--|
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### Field of Search:

Search of GB, EP, WO, & US patent documents classified in the following areas of the UKC<sup>V</sup>:

B7B

Worldwide search of patent documents classified in the following areas of the IPC<sup>7</sup>:

B62B

The following online and other databases have been used in the preparation of this search report :

WPI, EPODOC, JAPIO